

impress itself on anyone who refers to the *Physikalische Zeitschrift* or the publications of the Vienna Academy. The references in the present volume are evidence of Prof. Gockel's familiarity, not merely with recent work in German, but also with that in English, whether done here or in America. He makes, for instance, numerous references to Simpson's observations in Lapland.

The book consists of a three-page introduction, five chapters, and a short conclusion, and has a table of contents. Chapter i., pp. 4 to 61, deals with the electrical conductivity of the atmosphere. After describing Elster and Geitel's dispersion apparatus, and the instruments of Ebert and of Gerdien for measuring ionic charges and conductivity, it gives an account of the results obtained with these instruments by different observers in different places, and deals with the questions of diurnal variation and the influence of various meteorological conditions. Chapter ii., pp. 62 to 120, deals mainly with the potential gradient and its determination by means of water-droppers, flame and radium collectors. This includes the results obtained—especially in recent years—at the ground and those derived from balloon ascents. The diurnal and annual variations in the potential gradient, the relationships of potential gradient and ionisation, and the influence of meteorological conditions are amongst the subjects discussed. Chapter iii., pp. 120 to 149, describes the measurements by Gerdien and others of the vertical current in the atmosphere, deals with the charges brought down by rain and snow, and includes two or three pages on aurora. As evidence of its up-to-date character, it may be mentioned that it describes Mr. C. T. R. Wilson's apparatus for measuring the earth-air current. Chapter iv. is devoted to earth-currents. Its length, only $9\frac{1}{2}$ pages, forbids much detail, but there is an account of several of the more important observations, including those by Weinstein in Germany. Chapter v., pp. 159 to 202, deals with the sources of ionisation in the atmosphere. It discusses the radio-activity of air from the ground, and of rain, and the radio-active emanation in springs, the observations made by Elster and Geitel and others with negatively charged wires, and refers to recent work by Gerdien, Rutherford, Strutt, Campbell, Dike, Eve, and others. A few pages at the end relate to various theories.

In a book of such modest dimensions it is inevitable that some parts of the subject should not be very fully discussed, but it is unquestionably a work which every serious student of atmospheric electricity should possess and study. Very few points call for criticism. There are, however, two historical references which seem to overlook the work of British investigators. Mascart is referred to on p. 80 as the first to introduce photographic registration of potential difference, but in reality the Kelvin water-dropper at Kew has recorded photographically since 1861. Again, the discovery of the resemblance between the diurnal variations of potential gradient and barometric pressure is said on p. 114 to have been made by Hann in 1899. Prof. J. D. Everett, however, detected it in 1867 (*Phil. Trans.*, vol. clviii., p. 358, and plate xxi.).

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OUR BOOK SHELF.

The Ethical Aspects of Evolution, regarded as the Parallel Growth of Opposite Tendencies. By W. BENNETT. Pp. 220. (Oxford: The Clarendon Press, 1908.) Price 6s. net.

THIS book is full of original opinions vigorously and uncompromisingly expressed. As the title indicates, the author's main thesis is that the process of evolution does not mean the progressive elimination of evil and pain, or a progressively increasing surplus of good and pleasure. He adduces biological evidence to show that the organism which has attained the finest adjustment to its environment is the organism which can be most easily thrown out of adjustment, and the one to which misadjustment, when it comes, is most disastrous. So history teaches us that if civilisation has meant higher forms of virtue, it has also meant lower depths of vice; and that as our knowledge increases so does the consciousness of ignorance.

From this point of view, Mr. Bennett makes an effective destructive criticism on all optimistic evolutionary theories of ethics which have as central principle the possibility of perfect adjustment and the extrusion of all inharmonious factors from experience. He then proceeds to put forward his own theory. Failing the criterion of a net surplus result of progress in good or pleasure, Mr. Bennett holds that our system of valuations must rest on the conception of progress itself. A teleological basis, he admits, would be more adequate. But we are unable to find any finite end which will give unity to the divergent tendencies of human nature; and the transcendental end, though we are compelled to posit it, is for ever beyond our ken. The essential characteristic of progress is, for Mr. Bennett, increase of force; it is this which in the last possible analysis commands man's esteem and admiration, and affords a criterion of good and evil.

There is here an attempt to unite a scientific neutrality with a positive ethical construction. Progress is no increase in the net value of life; it means the impartial development of good and evil; yet progress must be our criterion of value and good. One need only point to Mr. Bennett's criticism of hedonism, where he points out that just because pleasure is an impartial stimulant of all sorts of action it cannot be the criterion of good, to show the inconsistency of this position. To avoid the difficulty by making progress represent only the positive aspect of evolution is to fall on the other horn of the perpetual dilemma of ethical construction, and make good the criterion of good. Apart from this defect of fundamental theory, Mr. Bennett's book shows considerable power of psychological analysis; his treatment in the later chapters of complex moral facts and concrete virtues is often admirable. His argument is always forceful, his style is powerful, and one feels throughout the presence of a straightforward insistence that we must face the facts as we find them of human nature and the world. These are qualities which go far towards a valuable re-handling of moral problems.

The Poisonous Terrestrial Snakes of our British Indian Dominions and how to recognise Them. By Major F. WALL. Second edition. Pp. x+69; illustrated. (Bombay: Natural History Society, 1908.) Price 2 rupees.

To those whose travels have never extended beyond western Europe it is a difficult matter to realise how largely poisonous snakes loom in the life of our native fellow-subjects in India, or to appreciate the heavy annual list of casualties due to snake-bite. To mitigate the evil, the European and the native medical staff of the country are now bringing into play the latest remedies of their science, but they are frequently

hampered in their endeavours by the difficulty of identifying the particular kind of noxious serpent with which they may be called upon to deal. It is largely with the view of supplying a ready method of making such identifications that the unpretentious work before us has been presented to the public. That it has been heartily appreciated is made evident by the fact of its having reached a second edition, after the sale of a first issue of 2500 copies. The author relies on the arrangement, size, and number of the scales as affording the easiest clue to the identification of species, and for this purpose gives figures of the scaling of certain parts of the body or head of a considerable number of the thirty-nine species recognised which in his opinion render identification easy and certain.

In the present edition the author has ventured to recognise more species than are admitted in Mr. Boulenger's volume in the "Fauna of British India." He is of opinion, for instance, that under the name of *Ancistrodon hypnale*, two species—one from Ceylon and the other from the Western Ghats—have been confounded, while a new krait is recognised from Assam, and the *Bungarus candidus* of Boulenger is split up into several species. In addition, *Pseudocerastes persicus* has recently been identified in British India. Apart from the special purpose in connection with snake-bite, the book is a useful and handy guide to the Indian "Thanatophidia."

R. L.

Gray's New Manual of Botany. Re-arranged and extensively revised by B. L. Robinson and M. L. Fernald. Seventh edition. Pp. 926. (New York: American Book Company, n.d.)

THIS well-known flora of the central and north-eastern parts of the United States of America was originally compiled in 1848 by Dr. Asa Gray, who was professor of natural history in Harvard University. It has passed through six editions, and has been revised three times, the last revision having been undertaken by Dr. S. Watson and Prof. J. M. Coulter in 1890. Another edition had become desirable if only to bring the book into conformity with the pronouncements of the International Botanical Congress at Vienna, and no more opportune occasion was likely to arise for carrying out at the same time the practically inevitable displacement of the arrangement of Bentham and Hooker's "Genera Plantarum" by the more modern system elaborated by Dr. Engler. These sweeping reforms have been effected by the new editors, who are botanical professors at Harvard University, and therefore officially entitled to prepare the flora, of which the copyright is held by the university.

The authors have also modified the geographical limits covered by the manual, whereby certain territories in the west are excluded, and considerable areas in Quebec, Ontario, and other Canadian provinces are included. The changes do not by any means end here; practically the arrangement of every important family—to use the word officially recommended for the group, better known as an *order*—and every large genus has been re-cast, so that the title of the book has been advisedly qualified. The assistance of specialists has been obtained for the descriptions of the grasses, orchids, *Crataegus*, and a few other genera.

The flora is confined to Pteridophyta and Spermatophyta; there is a considerable increase in the total number of species, that now exceeds four thousand. Under the genus *Panicum*, seventy-three species are distinguished, and under *Carex* as many as a hundred and eighty-five. The forms of *Crataegus*, a species that is highly variable in America, are brought under sixty-five species by Mr. W. W. Eggleston.

Undoubtedly the revision will be cordially welcomed

by botanists, and should prove especially useful to botanical workers in south-eastern Canada. The admirable series of analytical keys that were a feature of the older editions have been maintained, and further help is given for difficult genera in the shape of small illustrations, by the side of the text, of those parts of the plant that furnish diagnostic characters.

The New Word. By Allen Upward. New edition. Pp. 317. (London: A. C. Fifield, 1908.) Price 5s. net.

Scientific Corroboration of Theosophy: a Vindication of the Secret Doctrine by the Latest Discoveries. By Dr. A. Marques. Revised and greatly enlarged edition. Pp. iv + 152. (London: The Theosophical Publishing Society, 1908.) Price 2s. 6d. net.

MR. ALLEN UPWARD describes his book as "a plea for reason against authority," and proceeds to discuss a number of problems of modern science from a layman's point of view. Men of science will approve the spirit in which Mr. Upward writes, even if they remain unconvinced by his arguments.

Readers will discern from the title to his book the line of thought which characterises the volume of Dr. Marques.

LETTERS TO THE EDITOR.

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The Boiling Point of the Radium Emanation.

It was shown by Rutherford and Soddy in 1903 that the radium emanation was condensed from the gases with which it was mixed at a temperature of about -150° C. From observations of the range of temperature of condensation and volatilisation it was concluded that the condensed emanation exerted a sensible vapour pressure. This has been confirmed by later experiments, using much larger quantities of emanation. Sir William Ramsay and Cameron have pointed out that the emanation, condensed in a glass tube kept at the temperature of liquid air, can be removed by continuous pumping, thus indicating appreciable vapour pressure even at that low temperature. I have found that the rate of removal of the emanation in this way increases rapidly as the temperature of complete volatilisation is approached.

In the initial experiments of Rutherford and Soddy only very small quantities of radium were available, and the partial pressure of the emanation in the experiments was exceedingly small. If the emanation behaves like an ordinary gas, it is to be expected that the boiling point of pure emanation at atmospheric pressure should be much higher. I have recently made experiments to test this point. As the volume of pure emanation available in the present experiments was only about $1/20$ cubic millimetre it was necessary to employ special methods to investigate the boiling point of the emanation at various pressures. Purified emanation corresponding to the equilibrium amount from about 100 milligrams of radium was compressed into a fine glass capillary of about $1/20$ millimetre diameter. The end of the capillary dipped into a pentane bath, which was cooled down to any desired temperature, measured by means of a thermocouple. The point of initial condensation was marked by the appearance of a brilliant point of phosphorescent light, due to condensed emanation, at the coldest part of the capillary. In this way I have found that the temperature of initial condensation of the emanation rises from about -150° C. at a very low pressure to about -65° C. at atmospheric pressure. This fixes the boiling point of the emanation at atmospheric pressure at about -65° C., or 208° absolute.